

CLAIMS:

[C001] A method for co-producing hydrogen and electrical power comprising:

utilizing an intermittent renewable energy source to generate energy for producing hydrogen and oxygen;

transferring at least a portion of said energy to a production system to produce said hydrogen and said oxygen;

channeling at least a portion of said hydrogen to a hydrogen-delivery system configured to deliver the hydrogen from said hydrogen-delivery system to at least one of a power generation system or a hydrogen-storage system;

channeling at least a portion of said oxygen to an oxygen delivery system configured to deliver the oxygen from said oxygen delivery system to a biomass gasification system to produce a synthesis gas by partial oxidation of a biomass feedstock; and

channeling at least a portion of said synthesis gas to said power generation system to produce electrical power therefrom.

[C002] The method of claim 1, further comprises the steps of:

channeling at least a portion of said synthesis gas from said biomass gasification system to said hydrogen-reforming system to reform hydrogen; and

channeling said hydrogen from said hydrogen-reforming system to said hydrogen-delivery system further configured to deliver the hydrogen to at least one of said power generation system or said hydrogen-storage system.

[C003] The method of claim 1, wherein said power generation system comprises a hydrogen-based electricity production system.

[C004] The method of claim 3, wherein said hydrogen-based electricity production system comprises at least one of a fuel cell-based electricity production

system or a micro-turbine-based electricity production system or an internal combustion engine-based electricity production system or combinations thereof.

[C005] The method of claim 1, wherein said intermittent renewable energy comprises at least one of wind energy or solar energy or tidal energy.

[C006] The method of claim 1, wherein said energy comprises at least one of thermal energy or electrical energy.

[C007] The method of claim 1, wherein said production system is selected from the group consisting of an electrolysis system, a thermal splitting system, an electro-thermal splitting system, a thermo-chemical splitting system, a photo-chemical splitting system, a photo-electrochemical splitting system and combinations thereof.

[C008] The method of claim 1, wherein said biomass gasification system comprises at least one of a fixed bed biomass gasification system or a fluidized bed biomass gasification system.

[C009] The method of claim 1, wherein said biomass feedstock is selected from the group consisting of industrial wastes, agricultural wastes, municipal wastes, organic wastes, energy crops and combinations thereof.

[C010] A method for co-producing hydrogen and electrical power comprising:

utilizing an intermittent renewable energy source to generate energy for producing hydrogen and oxygen ;

transferring at least a portion of said energy to a production system to produce said hydrogen and said oxygen;

channeling at least a portion of said hydrogen to a hydrogen-delivery system configured to deliver the hydrogen from said hydrogen-delivery system to a hydrogen-based electricity production system to produce electrical power therefrom; and

channeling at least a portion of said oxygen to an oxygen delivery system configured to deliver the oxygen from said oxygen delivery system to a biomass gasification system to produce a synthesis gas by partial oxidation of a biomass feedstock.

[C011] The method of claim 10, further comprises the step of:

channeling said synthesis gas from said biomass gasification system to said hydrogen-reforming system to reform hydrogen; and

channeling said hydrogen from said hydrogen-reforming system to said hydrogen-delivery system configured to deliver the hydrogen from the hydrogen-delivery system to said hydrogen-based electricity production system to produce electrical power therefrom.

[C012] The method of claim 10, wherein said hydrogen-based electricity production system comprises at least one of fuel cell-based electricity production system or a micro-turbine-based electricity production system or an internal combustion engine-based electricity production system or a combination thereof.

[C013] The method of claim 10, wherein said intermittent renewable energy comprises at least one of wind energy or solar energy or tidal energy.

[C014] The method of claim 10, wherein said energy comprises at least one of thermal energy or electrical energy.

[C015] The method of claim 10, wherein said production system is selected from the group consisting of an electrolysis system, a thermal splitting system, an electro-thermal splitting system, a thermo-chemical splitting system, a photo-chemical splitting system, a photo-electrochemical splitting system and combinations thereof.

[C016] A method for co-producing hydrogen and electrical power comprising:

utilizing an intermittent renewable energy source to generate energy for producing hydrogen and oxygen;

transferring at least a portion of said energy to a production system to produce said hydrogen and said oxygen;

channeling said hydrogen to a hydrogen-delivery system configured to deliver the hydrogen from said hydrogen-delivery system to a power generation system to produce electrical power therefrom;

channeling said oxygen to an oxygen delivery system configured to deliver the oxygen from said oxygen delivery system to a biomass gasification system to produce a synthesis gas by partial oxidation of a biomass feedstock; and

channeling said synthesis gas to said power generation system to produce electrical power therefrom.

[C017] The method of claim 16, wherein said power generation system comprises a hydrogen-based electricity production system.

[C018] The method of claim 17, wherein said hydrogen-based electricity production system comprises at least one of fuel cell-based electricity production system or a micro-turbine-based electricity production system or an internal combustion engine-based electricity production system or a combination thereof.

[C019] The method of claim 16, wherein said intermittent renewable energy comprises at least one of wind energy or solar energy or tidal energy.

[C020] The method of claim 16, wherein said energy comprises at least one of thermal energy or electrical energy.

[C021] The method of claim 16, wherein said production system is selected from the group consisting of an electrolysis system, a thermal splitting system, an electro-thermal splitting system, a thermo-chemical splitting system, a photo-chemical splitting system, a photo-electrochemical splitting system and combinations thereof.

[C022] A system for co-producing hydrogen and electrical power comprising:

an energy generating system for generating energy from an intermittent renewable energy source;

a production system in energy communication with said energy generating system for producing hydrogen and oxygen;

a hydrogen-delivery system in fluid communication with said production system for receiving at least a portion of said hydrogen from said production system; said hydrogen-delivery system further configured to channel at least a portion of said hydrogen to at least one of a power generation system or a hydrogen storage system; and

an oxygen delivery system in fluid communication with said production system for receiving at least a portion of said oxygen from said production system; said oxygen delivery system further configured to channel at least a portion of said oxygen to a biomass gasification system;

wherein said biomass gasification system is further configured to channel at least a portion of a synthesis gas to said power generation system.

[C023] The system of claim 22 further comprising a hydrogen-reforming system for reforming said hydrogen from at least a portion of said synthesis gas;

wherein said hydrogen-reforming system is further configured to channel said hydrogen from said hydrogen-reforming system to said hydrogen-delivery system.

[C024] The system of claim 22, wherein said power generation system comprises a hydrogen-based electricity production system.

[C025] The system of claim 24, wherein said hydrogen-based electricity production system comprises at least one of fuel cell-based electricity production system or a micro-turbine-based electricity production system or an internal combustion engine-based electricity production system or a combination thereof

[C026] The system of claim 22, wherein said intermittent renewable energy comprises at least one of wind energy or solar energy or tidal energy.

[C027] The system of claim 22, wherein said energy comprises at least one of thermal energy or electrical energy.

[C028] The system of claim 22, wherein said production system is selected from the group consisting of an electrolysis system, a thermal splitting system, an electro-thermal splitting system, a thermo-chemical splitting system, a photo-chemical splitting system, a photo-electrochemical splitting system and combinations thereof

[C029] The system of claim 22, wherein said biomass gasification system comprises at least one of a fixed bed biomass gasification system or a fluidized bed biomass gasification system.

[C030] The system of claim 22, wherein said biomass feedstock is selected from the group consisting of industrial wastes, agricultural wastes, municipal waste, organic wastes, energy crops and combinations thereof.